What is Claimed:

1. An apparatus for stimulating a muscle of a subject, comprising:

a signal generator for generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein; and

an electrode apparatus for applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

wherein the predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein.

2. The apparatus of claim 1, wherein the electrical pulse signal induces contractions in the muscle within a range of 3Hz to 12Hz.

3. The apparatus of claim 2, wherein the electrical pulse signal for induces contractions in the muscle within a range of 4Hz to 8Hz.

4. The apparatus of claim 1, wherein said shivering phenomenon burns calories in the muscles of the subject without performing any external work by the subject.

5. The apparatus of claim 1, wherein a cardiovascular response is generated in response to the induced shivering phenomenon.

6. The apparatus of claim 5, wherein said cardiovascular response is greater than 50% maximum cardiac output.

7. The apparatus of claim 5, wherein said cardiovascular response is greater than 60%-70% maximum cardiac output.

8. The apparatus of claim 1, wherein the predetermined parameters of the electrical pulse signal generated by the signal generator are selected to minimize discomfort to the subject.

9. The apparatus of claim 1, wherein the electrical pulse signal comprises a plurality of single pulses at a frequency for inducing the contractions in the muscle of the subject within a predetermined frequency range.

10. The apparatus of claim 9, wherein said frequency range of the contractions induced in the muscle of the subject is from 3Hz to 12Hz.

11. The apparatus of claim 10, wherein the predetermined parameters of the pulses within each burst of pulses are selected such as to avoid contractions of the muscle at frequencies above 12Hz.

12. The apparatus of claim 1, wherein the electrical pulse signal comprises a plurality of bursts of pulses, the frequency of the respective bursts of pulses being such as to induce contractions in the muscle of the subject within a predetermined frequency range.

13. The apparatus of claim 12, wherein the said frequency range of the contractions induced in the muscle of the subject is from 3Hz to 12 Hz.

14. The apparatus of claim 13, wherein the predetermined parameters of the pulses within each burst of pulses are selected such as to avoid contractions of the muscle at frequencies above 12Hz.

15. The apparatus of claim 1, wherein a charge-per-pulse of one or more pulses of the electrical pulse signal, and the electrode apparatus for applying the pulse signal to the subject co-operate with each other to maintain the charge-per-pulse per unit area of the applied electrical pulse signal at or below 16C/mm$^2$ in the subject.

16. The apparatus of claim 15, wherein the current density is maintained at or below 0.1 mA/mm$^2$.

17. The apparatus of claim 1, wherein a maximum charge-per-pulse of the electrical pulse signal exceeds approximately 60 μC.

18. The apparatus of claim 1, wherein the electrode apparatus for applying the pulse signal to the subject comprises an electrode.

19. The apparatus of claim 1, wherein the electrode apparatus for applying the pulse signal to the subject comprises a plurality of electrodes.

20. The apparatus of claim 19, wherein the effective electrically conductive contact area of at least one electrode is not less than 7,500 $mm^2$.

21. The apparatus of claim 20, wherein the effective electrically conductive contact area of at least one electrode is not less than 10,000 $mm^2$.

22. The apparatus of claim 21, wherein the effective electrically conductive contact area of at least one electrode is not less than 15,000 $mm^2$.

23. The apparatus of claim 19, wherein at least one of the electrodes has an effective electrical contact area such that the length of the effective electrical contact area is substantially similar to the width of the muscle to be stimulated.

24. The apparatus of claim 23, wherein when it is desired to stimulate a quadricep or hamstring muscle group in a male of average size, it is preferred that the length of the effective electrical contact area of the relevant electrode is at least 140 mm.

25. The apparatus of claim 24, wherein when it is desired to stimulate a quadricep or hamstring muscle group in a male of average size, it is preferred that the length of the effective electrical contact area of the relevant electrode is at least 190 mm.

26. The apparatus of claim 19, wherein at least one of the electrodes has an effective electrical contact area such that a maximum charge may be applied to the muscle of the subject while minimizing discomfort to the subject.

27. An apparatus for stimulating a muscle of a subject, comprising:

a signal generator for generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein; and

an electrode apparatus for applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

wherein the predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein; and

wherein the pulse signal comprises a plurality of single pulses, and the frequency of the respective pulses lies in the range 4Hz to 12Hz.

28. The apparatus of claim 27 wherein the pulse signal comprises a plurality of single pulses, and the frequency of the respective pulses lies in the range of 4Hz to 8Hz.

29. The apparatus of claim 27, wherein at least two of said plurality of single pulses are of different amplitudes.

30. An apparatus for stimulating a muscle of a subject, comprising:

a signal generator for generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein; and

an electrode apparatus for applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

wherein the predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein; and

wherein the pulse signal comprises a plurality of bursts.

31. The apparatus of claim 30, wherein the frequency of the bursts lie in the range of 3Hz to 12Hz.

32. The apparatus of claim 31, wherein the frequency of the bursts lie in the range 4Hz to 8Hz.

33. The apparatus of claim 30, wherein the frequency of the pulses within each burst of pulses is greater than 20 Hz.

34. The apparatus of claim 30, wherein the current amplitude of respective pulses within each burst are within an envelope which defines a curve which rises from a first lower current amplitude value to a peak current amplitude value, and then returns to a second lower amplitude value.

35. The apparatus of claim 34, wherein the first and second lower current amplitude values are substantially similar.

36. The apparatus of claim 34, wherein two adjacent pulse signals of each burst of pulse signals adjacent to the peak amplitude value of the envelope are of a substantially similar current amplitude value.

37. The apparatus of claim 34, wherein the first and second lower amplitude values of a particular burst do not exceed more than approximately 60% of the peak amplitude value of the particular burst.

38. The apparatus of claim 30, wherein where each burst of pulses comprises two or more pulses, the respective pulses in the burst of pulses may be of similar or different current amplitude values.

39. The apparatus of claims 30, wherein each pulse burst comprises two pulses.

40. The apparatus of claim 39, wherein an amplitude of one of said two pulses does not exceed more than approximately 60% of the amplitude of the second pulse of said two pulses.

41. The apparatus of claim 39, wherein a charge of one or said two pulses does not exceed more than approximately 60% of the charge of the second pulse of said two pulses.

42. An apparatus for stimulating a muscle of a subject, comprising:

a signal generator for generating an electrical pulse signal; and

an electrode apparatus for applying the signal to the muscle of a subject;

wherein one or more predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein for inducing cardiovascular training effects in the subject.

43. The apparatus of claim 42, wherein said cardiovascular training induces relatively significant calorie usage in the subject.

44. The apparatus of claim 42, wherein said cardiovascular training induces one or more benefits of aerobic exercise in the subject.

45. An apparatus for stimulating a muscle of a subject, comprising:

a signal generator for generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein; and

an electrode apparatus for applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

wherein the predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein; and

wherein said electrode apparatus is provided in a garment.

46. The apparatus of claim 45, wherein said electrode apparatus is fixed to an internal surface of said garment as to contact the skin of a subject when in use.

47. The apparatus of claim 46, wherein said garment applies a force to said electrode apparatus, thereby compressing the electrode apparatus against the skin.

48. The apparatus of claim 46, wherein said garment includes a banding system for applying a force to said electrode apparatus, therefore compressing the electrode apparatus against the skin.

49. The apparatus of claim 45, wherein said electrode apparatus exerts a pressure on said skin.

50. The apparatus of claim 49, wherein said pressure is maximized without discomfort to the subject.

51. The apparatus of claim 50, wherein said pressure is approximately 40 mm Hg.

52. The apparatus of claim 45, wherein said cardiovascular training induces one or more benefits of aerobic exercise in the subject.

53. An apparatus for stimulating a muscle of a subject, comprising:

a signal generator for generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein; and

an electrode apparatus for applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

wherein the predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein; and

wherein an amplitude of said electrical pulse signal is selected at a level to allow normal sleep of a subject during use.

54. The apparatus of claim 53, wherein said amplitude of said pulse signal is varied in accordance with a determined sleep depth of the subject.

55. The apparatus of claim 53, wherein said amplitude of said pulse signal is varied in accordance with a predetermined timing sequence.

56. An apparatus for stimulating a muscle of a subject, comprising:

a signal generator for generating an electrical pulse signal in accordance with one more predetermined parameters for stimulating the muscle by inducing contractions therein;

an electrode apparatus for applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

a monitor for monitoring one or more physiological parameters of a subject; and

a feedback mechanism for controlling said signal generator based upon an output of said monitor;

wherein the predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein.

57. The apparatus of claim 56, wherein said monitor comprises a heart rate monitor, said feedback mechanism varying said predetermined parameters of said electrical pulse based upon a heart rate of said subject.

58. The apparatus of claim 56, wherein said monitor calculates calorie expenditure by the subject, said feedback mechanism controlling said apparatus in accordance with said calculated calorie expenditure.

59. The apparatus of claim 56, wherein said monitor comprises an accelerometer, said accelerometer being positioned adjacent said muscle and measuring a magnitude of said shivering, said feedback mechanism controlling said apparatus in accordance with a measured magnitude of said shivering.

60. An apparatus for stimulating muscles of a subject, comprising:

a signal generator for generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscles by inducing contractions therein; and

an electrode apparatus for applying the signal to nerves associated with the muscles of the subject to be stimulated for stimulating the muscles;

wherein the predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscles being subjected to the contractions so as to induce a shivering phenomenon therein; and

wherein said electrode apparatus comprises a plurality of electrodes.

61. The apparatus of claim 60, wherein said electrical pulse signal is transmitted between two of said plurality of electrodes placed on a single limb of said subject.

62. The apparatus of claim 60, wherein said electrical pulse signal is transmitted between two of said plurality of electrodes placed on different limbs of said subject.

63. The apparatus of claim 60, wherein said electrical pulse signal is transmitted between a combination of said plurality of electrodes placed on a single limb of said subject.

64. The apparatus of claim 63, wherein said electrical pulse signal is selectively transmitted between predetermined combinations of said plurality of electrodes in order to preferentially stimulate different muscles of said subject.

65. The apparatus of claim 60, wherein said electrical pulse signal is transmitted between a combination of said plurality of electrodes placed on different limbs of said subject.

66. The apparatus of claim 65, wherein said electrical pulse signal is selectively transmitted between predetermined combinations of said plurality of electrodes in order to preferentially stimulate different muscles of said subject.

67. A method for stimulating a muscle of a subject, comprising the steps of:

generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein;

applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle; and

selecting the predetermined parameters of the electrical pulse signal so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein.

68. The method of claim 67, wherein the electrical pulse signal induces contractions in the muscle within a range of 3Hz to 12Hz.

69. The method of claim 68, wherein the electrical pulse signal for induces contractions in the muscle within a range of 4Hz to 8Hz.

70. The method of claim 67, wherein said shivering phenomenon burns calories in the muscles of the subject without performing any external work by the subject.

71. The method of claim 67, wherein a cardiovascular response is generated in response to the induced shivering phenomenon.

72. The method of claim 71, wherein said cardiovascular response is greater than 50% maximum cardiac output.

73. The method of claim 71, wherein said cardiovascular response is greater than 60%-70% maximum cardiac output.

74. The method of claim 67, further comprising the step of selecting the predetermined parameters of the electrical pulse signal generated by the signal generator to minimize discomfort to the subject.

75. The method of claim 67, wherein the electrical pulse signal comprises a plurality of single pulses at a frequency for inducing the contractions in the muscle of the subject within a predetermined frequency range.

76. The method of claim 75, wherein said frequency range of the contractions induced in the muscle of the subject is from 3Hz to 12Hz.

77. The method of claim 76, wherein the predetermined parameters of the pulses within each burst of pulses are selected such as to avoid contractions of the muscle at frequencies above 12Hz.

78. The method of claim 67, wherein the electrical pulse signal comprises a plurality of bursts of pulses, the frequency of the respective bursts of pulses being such as to induce contractions in the muscle of the subject within a predetermined frequency range.

79. The method of claim 78, wherein the said frequency range of the contractions induced in the muscle of the subject is from 3Hz to 12 Hz.

80. The method of claim 79, further comprising the step of selecting the predetermined parameters of the pulses within each burst of pulses such as to avoid contractions of the muscle at frequencies above 12Hz.

81. The method of claim 67, wherein a charge-per-pulse of one or more pulses of the electrical pulse signal, and the electrode apparatus for applying the pulse signal to the subject co-operate with each other to maintain the charge-per-pulse per unit area of the applied electrical pulse signal at or below 16C/mm$^2$ in the subject.

82. The method of claim 81, wherein the current density is maintained at or below 0.1 mA/mm$^2$.

83. The method of claim 67, wherein a maximum charge-per-pulse of the electrical pulse signal exceeds approximately 60 μC.

84. The method of claim 67, wherein the pulse signal is applied to the subject by an electrode.

85. The method of claim 67, wherein the pulse signal is applied to the subject by a plurality of electrodes.

86. The method of claim 85, wherein the effective electrically conductive contact area of at least one electrode is not less than 7,500 $mm^2$.

87. The method of claim 86, wherein the effective electrically conductive contact area of at least one electrode is not less than 10,000 $mm^2$.

88. The method of claim 87, wherein the effective electrically conductive contact area of at least one electrode is not less than 15,000 $mm^2$.

89. The method of claim 85, wherein at least one of the electrodes has an effective electrical contact area such that the length of the effective electrical contact area is substantially similar to the width of the muscle to be stimulated.

90. The method of claim 89, wherein when it is desired to stimulate a quadricep or hamstring muscle group in a male of average size, it is preferred that the length of the effective electrical contact area of the relevant electrode is at least 140 mm.

91. The method of claim 90, wherein when it is desired to stimulate a quadricep or hamstring muscle group in a male of average size, it is preferred that the length of the effective electrical contact area of the relevant electrode is at least 190 mm.

92. The method of claim 85, wherein at least one of the electrodes has an effective electrical contact area such that a maximum charge may be applied to the muscle of the subject while minimizing discomfort to the subject.

93. A method for stimulating a muscle of a subject, comprising the steps of:

generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein;

applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle; and

selecting the predetermined parameters of the electrical pulse signal so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein;

wherein the pulse signal comprises a plurality of single pulses, and the frequency of the respective pulses lies in the range 4Hz to 12Hz.

94. The method of claim 93, wherein the pulse signal comprises a plurality of single pulses, and the frequency of the respective pulses lies in the range of 4Hz to 8Hz.

95. The method of claim 93, wherein at least two of said plurality of single pulses are of different amplitudes.

96. A method for stimulating a muscle of a subject, comprising the steps of:

generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein;

applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

selecting the predetermined parameters of the electrical pulse signal so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein;

wherein the pulse signal comprises a plurality of bursts.

97. The method of claim 96, wherein the frequency of the bursts lie in the range of 3Hz to 12Hz.

98. The method of claim 97, wherein the frequency of the bursts lie in the range 4Hz to 8Hz.

99. The method of claim 96, wherein the frequency of the pulses within each burst of pulses is greater than 20 Hz.

100. The method of claim 96, wherein the current amplitude of respective pulses within each burst are within an envelope which defines a curve which rises from a first lower current amplitude value to a peak current amplitude value, and then returns to a second lower amplitude value.

101. The method of claim 100, wherein the first and second lower current amplitude values are substantially similar.

102. The method of claim 100, wherein two adjacent pulse signals of each burst of pulse signals adjacent to the peak amplitude value of the envelope are of a substantially similar current amplitude value.

103. The method of claim 100, wherein the first and second lower amplitude values of a particular burst do not exceed more than approximately 60% of the peak amplitude value of the particular burst.

104. The method of claim 96, wherein where each burst of pulses comprises two or more pulses, the respective pulses in the burst of pulses may be of similar or different current amplitude values.

105. The method of claims 96, wherein each pulse burst comprises two pulses.

106. The method of claim 105, wherein an amplitude of one of said two pulses does not exceed more than approximately 60% of the amplitude of the second pulse of said two pulses.

107. The method of claim 105, wherein a charge of one or said two pulses does not exceed more than approximately 60% of the charge of the second pulse of said two pulses.

108. A method for stimulating a muscle of a subject, comprising the steps of:

generating an electrical pulse signal;

applying the signal to the muscle of a subject; and

selecting one or more predetermined parameters of the electrical pulse signal so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein for inducing cardiovascular training effects in the subject.

109. The method of claim 108, wherein said cardiovascular training induces relatively significant calorie usage in the subject.

110. The method of claim 108, wherein said cardiovascular training induces one or more benefits of aerobic exercise in the subject.

111. A method for stimulating a muscle of a subject, comprising the steps of:

generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein;

applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

selecting the predetermined parameters of the electrical pulse signal so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein;

wherein an electrode apparatus for applying said signal is provided in a garment.

112. The method of claim 111, further comprising the steps of fixing said electrode apparatus to an internal surface of said garment as to contact the skin of a subject when in use.

113. The method of claim 112, wherein said garment applies a force to said electrode apparatus, thereby compressing the electrode apparatus against the skin.

114. The method of claim 112, wherein said garment includes a banding system for applying a force to said electrode apparatus, therefore compressing the electrode apparatus against the skin.

115. The method of claim 111, wherein said electrode apparatus exerts a pressure on said skin.

116. The method of claim 115, wherein said pressure is maximized without discomfort to the subject.

117. The method of claim 116, wherein said pressure is approximately 40 mm Hg.

118. The method of claim 111, wherein said cardiovascular training induces one or more benefits of aerobic exercise in the subject.

119. A method for stimulating a muscle of a subject, comprising the steps of:

generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscle by inducing contractions therein;

applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

selecting the predetermined parameters of the electrical pulse signal so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein; and

selecting an amplitude of said electrical pulse signal is selected at a level to allow normal sleep of a subject during use.

120. The method of claim 119, further comprising the step of varying said amplitude of said pulse signal in accordance with a determined sleep depth of the subject.

121. The method of claim 119, further comprising the step of varying said amplitude of said pulse signal in accordance with a predetermined timing sequence.

122. A method for stimulating a muscle of a subject, comprising the steps of:

generating an electrical pulse signal in accordance with one more predetermined parameters for stimulating the muscle by inducing contractions therein;

applying the signal to nerves associated with the muscle of the subject to be stimulated for stimulating the muscle;

monitoring one or more physiological parameters of a subject;

controlling said signal generator based upon an output of said monitoring; and

selecting the predetermined parameters of the electrical pulse signal so as to maximize the bulk of the muscle being subjected to the contractions so as to induce a shivering phenomenon therein.

123. The method of claim 122, wherein said monitoring is performed by a heart rate monitor, and said predetermined parameters of said electrical pulse are varied based upon a heart rate of said subject.

124. The method of claim 122, wherein said monitoring is performed calculating calorie expenditure by the subject, and said muscle is stimulated in accordance with said calculated calorie expenditure.

125. The method of claim 122, wherein said monitoring is performed by an accelerometer, said accelerometer being positioned adjacent said muscle and measuring a magnitude of said shivering, and said muscle is stimulated in accordance with a measured magnitude of said shivering.

126. A method for stimulating muscles of a subject, comprising the steps of:

generating an electrical pulse signal in accordance with one or more predetermined parameters for stimulating the muscles by inducing contractions therein; and

applying the signal to nerves associated with the muscles of the subject to be stimulated for stimulating the muscles; and

selecting the predetermined parameters of the electrical pulse signal are selected so as to maximize the bulk of the muscles being subjected to the contractions so as to induce a shivering phenomenon therein;

wherein said signal is applied by a plurality of electrodes.

127. The method of claim 126, further comprising the step of transmitting said electrical pulse signal between two of said plurality of electrodes placed on a single limb of said subject.

128. The method of claim 126, further comprising the step of transmitting said electrical pulse signal between two of said plurality of electrodes placed on different limbs of said subject.

129. The method of claim 126, further comprising the step of transmitting said electrical pulse signal between a combination of said plurality of electrodes placed on a single limb of said subject.

130. The method of claim 129, further comprising the step of selectively transmitting said electrical pulse signal between predetermined combinations of said plurality of electrodes in order to preferentially stimulate different muscles of said subject.

131. The method of claim 126, further comprising the step of transmitting said electrical pulse signal between a combination of said plurality of electrodes placed on different limbs of said subject.

132. The method of claim 131, further comprising the step of selectively transmitting said electrical pulse signal between predetermined combinations of said plurality of electrodes in order to preferentially stimulate different muscles of said subject.